NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Intelligent Systems Division
Moffett Field, California 94035-0001

DRAFT
STATEMENT OF WORK
For
INTELLIGENT SYSTEMS RESEARCH AND DEVELOPMENT SUPPORT – 2 (ISRDS-2)

February 13, 2013

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1.0 INTRODUCTION

The Intelligent Systems Division (hereafter referred to as Code TI or the Division) is part of the Exploration Technology Directorate (Code T) at the NASA Ames Research Center. Code TI conducts scientific research, develops technologies, builds applications, and infuses and deploys advanced information systems technology into NASA missions and other federal government projects. This procurement is for research, development and technology infusion support services to assist that effort.

The Division is a major contributor to enabling intelligent software technology research and development for NASA in all of the NASA Mission Directorates. Programs supported by the Division include Aviation Safety, Fundamental Aeronautics, and Airspace Operations for the Aeronautics Research Mission Directorate (ARMD); Airborne, Space and Earth Science data pipelines and analyses, and mission operations for the Science Mission Directorate (SMD); evolving advanced space technology development and demonstration programs in the Office of the Chief Technologist (OCT); Advanced Exploration Systems, Human/Robotic systems and other capability-driven programs being developed in the Human Exploration and Operations Mission Directorate (HEOMD); the Center's Small Satellite Research projects, in addition to a variety of NASA inter-center work agreements such as one to provide specialized software systems for Johnson Space Center's Mission Operations Directorate (MOD).

Laboratories are operated by Code TI for many of the scientific and engineering disciplines under the purview of the Division. Code TI maintains strong relationships with other U.S. government agencies, industrial organizations, and academic partners for the purposes of joint research and rapid technology transfer.

Code TI is composed of technology-based groups, each with expertise to support all of the Mission Directorates. The technologies currently emphasized are described in Section 2.2 of the Scope of Work that follows. Many projects require participation across multiple technology groups.

The requirements to be performed are described in the following sections.

2.0 SCOPE OF WORK

The Contractor shall provide research support in the following domains: artificial intelligence (AI), knowledge-based systems, knowledge discovery and data mining, information processing and sensors, prognostic signal analysis, model-based diagnostic reasoning, system fault diagnostics, automated software methodologies, fault-tolerant computing hardware and networking, tele-presence and tele-control of remote, mobile platforms, autonomous and adaptive control, human-centered computing, collaborative system design, and distribution of research information in various formats and forums.

The following descriptions represent the Government's best effort to project future research support requirements. The core requirements for this contract are outlined in Sections 2.1 and 2.2. Due to the research and development nature of Code TI's missions, remaining requirements will be under Section 2.3 where the descriptions should not be regarded as specific representations of future research support requirements but are instead a general description of the kinds of research support requirements that may arise over the course of the contract.

The Contractor shall be responsible for providing flexible, responsive, coordinated, and comprehensive research support services that are within the framework of the core requirements. The Government will provide specific requirements for the core research at time of award. The Contractor shall administer all work to be performed under the core, and assure the availability of qualified personnel and resources.

The Government will use Contract Task Orders (CTO) to support the IDIQ requirements under Section 2.3. Task orders will contain defined requirements (such as deliverables and significant milestone dates), negotiated cost and maximum fee, and established performance measurement criteria. The Contractor shall administer all work to be performed under this contract, and assure the availability of qualified personnel for timely response to negotiated CTOs. Individual task plans shall be negotiated and managed on a per task basis. Technical progress and resource expenditures for each task order shall be reported monthly by the Contractor to the Government.

2.1 Core Support Functions

2.1.1 Core Management

The Contractor shall provide overall management and administrative functions to ensure that the proper resources are available and allocated, that required reports and documentation are prepared, and that the overall environment supports the research requirements. The Contractor shall perform the following core management support functions:

(1) Manage the contract in a fiscally responsible manner, fulfilling all requirements for the core work as well as under the IDIQ task orders.
(2) Provide a well-defined, stable organizational structure with clear lines of authority and clearly identified interfaces to the Government.
(3) Provide secretarial and financial services for their employees.
(4) Provide staff with training in state-of-the-art information technologies.
(5) Comply with Government policies and regulations including the Ames Management System (AMS) and relevant AMS policies (See Section 3.0)
(6) Manage the resources allocated by NASA for specific tasks in a manner to ensure research goals are reached in accordance with agreed-upon milestones.
(7) Develop, implement and maintain a discrepancy reporting and tracking system. Discrepancy reports may be issued by the Contractor as well as by NASA regarding technical, resource or financial issues that may prevent the meeting of milestones or the performance of the task. The system shall assure that all discrepancies are documented and resolved. Discrepancy histories shall be reviewed for indications of systematic or recurring problems that require correction and to identify areas for future process improvements.

(8) Provide a monthly report of the state of all tasks, identifying accomplishments, publications, and major milestones reached as well as problems and concerns over issues that may affect contract performance along with recommended solutions.
(9) Provide property management to ensure accountability for government furnished equipment (GFE) and facilities and maintain responsibility for annual inventory surveys and accountability verification forms.
(10) Provide the risk management activities that will be used to ensure that the Government has adequate insight into the risks associated with the Contractor's ability to accomplish the required work.

2.1.2 Core Technical Area Support

It is anticipated that the Contractor shall perform the following core support functions as required for the four core research areas:

(1) Collaborate and exchange technical information with the Government research staff.
(2) Provide research support, including direct research functions and indirect support such as technical and programmatic reviews.
(3) Provide short turn-around deliverables for specific project milestones.
(4) Conform to all relevant standards and practices (configuration management, system integration requirements, etc.) for all projects and deliverables.
(5) Support technology infusion/deployment efforts with NASA customers.
(6) Attend and participate in group and project meetings.
(7) Present research, work in progress, and results to civil service management and to research peers at conferences.
(8) Support (occasionally short-notice) preparations for demonstrations and presentations of research, work in progress, and results to visitors and technical delegates, including supporting and/or hosting of technical workshops as needed.
(9) Travel as needed to conferences, field sites, universities, and other agencies in the performance of research, integration of products, technology infusion, and other important demonstration of results.

2.1.3 Core Operational Support

Provide computing environment for the technical research identified in Section 2.2. Support will include design, implementation and management of the Division research IT infrastructure. The Contractor must provide a comprehensive, fully integrated heterogeneous computing environment for the scientific research community. The system architecture must support on-site resources as well as operational deployments. The Contractor shall proactively research and test state-of-the-art technologies and deploy those technologies to the existing infrastructure in a seamless non-intrusive manner in coordination with each project. The Contractor shall have a strong understanding of all NASA safety and security requirements as mandated by NASA computer security.

Specific duties to be performed include –
System architecture design

System configuration definition and implementation
Security plan development
Integration of server systems
Support of user systems

2.2 Core Technology Research Areas

The Intelligent Systems Division performs research in four main technology areas. As the research matures or as projects require, work from multiple areas can be matrixed to support a single task, project or program.

Technology Area 1: Autonomous Systems and Robotics (ASR)

The Contractor shall support the ASR Technology Area, which covers the missions of the Autonomous Systems and Robotics groups, consisting principally of four main sub-areas: (a) planning and scheduling, (b) intelligent robotics, (c) applied avionics software and (d) advanced control.

The Contractor shall provide research support in areas of expertise including artificial intelligence, robotics, computer vision, aeronautics, theoretical computer science, operations research, software engineering, electrical engineering, and discrete and continuous control. The Contractor shall support small spacecraft mission operations, human spaceflight mission operations, and rotorcraft and science mission operations using both manned and unmanned fixed wing aircraft.

The planning and scheduling sub-area research supports NASA ground and flight operations. The Contractor shall support research efforts in complex temporal constraints (e.g., when activities like communication can only be done during certain time windows or in a particular order), limited resources (rovers and spacecraft have very limited energy and memory available), over-subscription and optimization, uncertainty, and control.

The intelligent robotics sub-area enables humans and robots to explore and learn about extreme environments, remote locations, and uncharted worlds. The Contractor shall support applied research in a wide range of areas with an emphasis on robotics systems science and field tests, applied computer vision (navigation, planetary mapping, and automated science support), interactive 3D user interfaces, robot software architecture, and planetary rovers.

The applied avionics software sub-area performs applied research, development, operation, and testing of avionics software for flight missions. The Contractor shall support raising the Technology Readiness Level (TRL) of autonomy technologies and integrating autonomy systems into flight software. The Contractor shall support the development and deployment of avionics software for a wide variety of missions including Small Sats, Nano Sats (e.g., CubeSats), payloads, deployers/sequencers, and launch vehicles.

The advanced control sub-area conducts research, development, and validation of advanced guidance, navigation, and control technologies for many aeronautical applications. The Contractor shall support research in prediction of loss-of control, and development of improved Flight Management Systems (FMS) for tactical and emergency flight planning and guidance; and constrained trajectory generation aimed at developing optimal trajectories under damaged and failure scenarios. The Contractor shall support development and execution of simulation experiments conducted to evaluate the FMS technologies being developed.

The advanced control sub-area also conducts multidisciplinary design, analysis, and optimization (MDAO) of advanced aircraft control concepts to enable efficient and safe operation of next-generation aircraft systems. In particular, the Contractor shall support research in active wing shaping control technologies for drag reduction which includes physics-based multidisciplinary modeling to develop integrated coupled physics models of aircraft aerodynamics and flight dynamics coupled with aero-elasticity.

The Contractor will provide software development support with state of the art experience in engineering and testing of high-performance embedded, application, and processing software in a variety of languages (C, C++, Python, Java, LISP, Matlab, Simulink) on a variety of platforms (Linux, OS-X, Windows, VxWorks). Application frameworks include Eclipse, Spring, Hibernate, Ajax and HTML5. Also required is expertise in 3D visualization, user interface design, and associated development tools.

The Contractor shall perform research and develop distributed coordination and collaboration capabilities that enable autonomous systems and humans to act as teams. This includes design, development, and deployment of the associated command and control systems and environments used to conduct mission planning, monitoring of remote autonomous systems, and interactions with those systems. Contractor staff may be tasked to support or participate in deployments and field campaigns in remote, austere sites, or to support extended flight test activities at other Government sites.

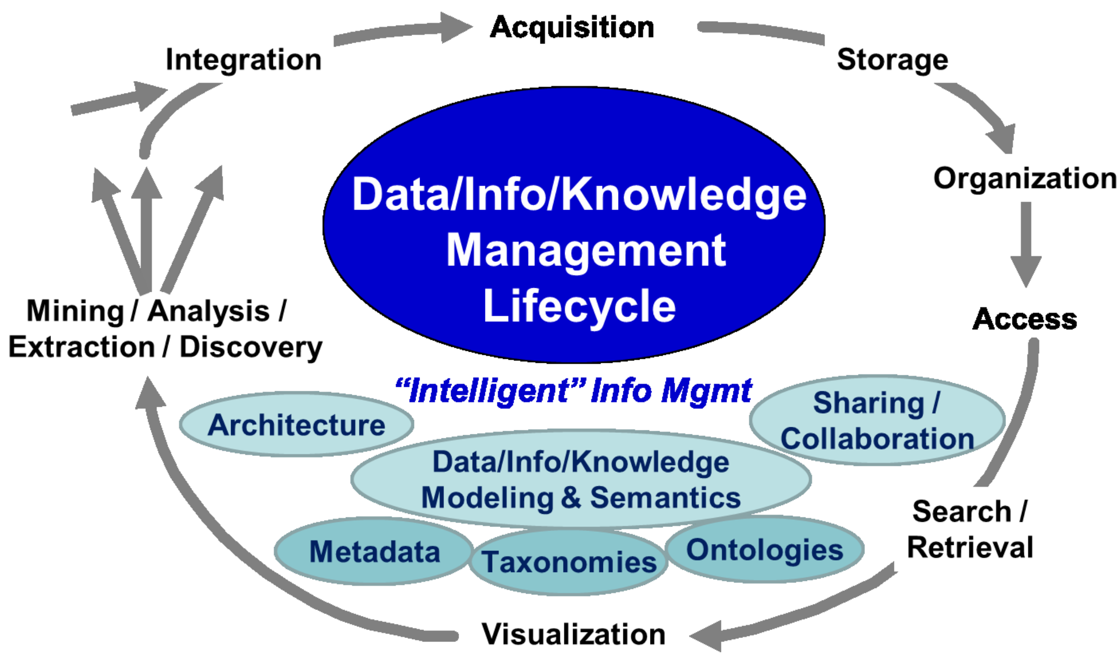
The Contractor shall employ a broad range of Artificial Intelligence (AI) methods to the missions and tasks such as model-based reasoning and simulation, planning and scheduling, constraint-based reasoning, local and global optimization, decision theory, machine learning, intelligent synthesis, multi-agent coordination, and other innovative or traditional techniques.

Technology Area 2: Collaborative & Assistant Systems (CAS)

The Contractor shall support the CAS Technology Area, which covers missions of the Collaborative and Assistant Systems projects. The Contractor will be involved in research, development, and deployment of methods that provide computer-based support for daily work activities of scientists, engineers, managers, and operational support personnel contributing to major NASA aeronautics and space programs. The Contractor will be involved in research, development and operational sustainment activities that require analysis of work environments, technology needs, and communication patterns. The Contractor shall design and develop advanced collaboration, communication, and performance support systems, and deliver these on conventional and mobile computing platforms. The Contractor shall employ and integrate a broad range of technologies including collaborative systems design, groupware, work systems simulation, information indexing and retrieval, intelligent interfaces, adaptive systems, wireless technologies, information visualization, intelligent agents, data/information analysis techniques, knowledge-based systems, and other innovative or established technologies. The Contractor shall focus application efforts so as to satisfy mission requirements in major NASA programs such as Earth Sciences, Space

Sciences, Human Exploration and Development of Space, Space Operations, Airspace Systems and Aviation Safety and Security.

The core focus of this technology area includes (but is not limited to) Information Management Technologies and Human Centered Computing focused projects and applications. Information Management Technologies include data, information, and knowledge management for the entire lifecycle, including system and information architecture, ontologies, taxonomies, modeling and semantics, and systems that facilitate sharing and collaboration.



Human Centered Computing involves participatory design and project partnerships, ethnography, empirical requirements analysis, work practice simulation, and simulation-to-implementation system development.

A recent example of such an effort that combines the core focus of the technology area was the development of the Common Operations and Management Portal for Airborne Science Systems, a distributed science and engineering support environment as a computer-supported cooperative web application. Such work involves science and engineering software development, and the specification, design, development, and integration of information for use by a science and engineering user community. The task thus includes substantial communication and interfacing with a broad range of users in order to understand the needs that drive development requirements, in addition to the development of the hardware and software systems to support the resultant application and integration, and technology infusion for production use.

Technology Area 3: Discovery and Systems Health (DaSH)

The Contractor shall support the DaSH Technology Area, which covers the objectives of the Discovery and Systems Health technology area that encompasses four groups, Diagnostics and

Prognostics, Intelligent Data Understanding, Integrated System Health Management (ISHM) Technology Maturation, and Physics-based Methods. The Contractor will be involved in research, development, and deployment of advanced software technology supporting the development of diagnostic and prognostic algorithms and uncertainty management techniques; the development of standards and metrics for measuring the performance of ISHM algorithms; and the investigation of component fault behavior and damage progression. The Contractor shall also support fundamental research to create tools and methods to aid in the assimilation and understanding of scientific and engineering data to best advance NASA's missions; the application and maturation of health management technologies utilizing simulation testbeds, hardware-in-the-loop testbeds, and flight experiments. The Contractor shall support research to understand physical phenomena and mechanisms in design tradeoff studies and integrated vehicle environments, including root causes of system failure as well as risk identification, assessment, and mitigation.

The Contractor shall support research into quantum computing algorithms and hardware; quantum annealing for combinatorial optimization; understanding the role of noise and decoherence in quantum computing devices; and in an interdisciplinary way, combining laboratory and field experimental tests, physics-based modeling and analysis, and technologies for data analysis and statistical model and state inference. Advanced software technology includes the development of algorithms that support modeling, simulation, diagnosis, prognostics, data mining, analysis and display. Specific support will be in the development and deployment of advanced algorithms, such as model-based diagnosis, prognostic life estimation models, physics-based models, traditional machine learning, learning from partial or incomplete models, stochastic nonlinear model identification, Bayesian and other statistical and model-based learning methods, and decision support.

The main products from this technology area are advanced software tools and applications applicable to a wide range of internal NASA programs such as SLS, Ground Operations, Deep Space Habitat, Aviation Safety, Avionics Health State Assessment and Management, wiring fault analysis, and external activities including aviation security applications and spacecraft applications with other government agencies.

Technology Area 4: Robust Software Engineering (RSE)

The Contractor shall support the objectives of the Robust Software Engineering Technical Research Area and be involved in research, development, and deployment of advanced software engineering tools into NASA missions. RSE is organized under three interrelated themes (1) advanced verification and validation techniques, (2) safety assurance technology, (3) model-based software engineering and applications. The Contractor shall report research results in appropriate technical journals, and at conferences and workshops. RSE research results are matured as prototypes and advanced software tools targeted to NASA's engineering lifecycle. The emphasis will be on maturation and adaptation of the tools so they can be incorporated directly into the software development and verification process and validation used in different NASA missions. In order to do this, the tools will need to be adapted to interoperate with specific commercial tools already chosen within targeted NASA projects.

The advanced verification and validation theme encompasses a wide range of formal and quantitative techniques. Contractor shall have deep expertise in how virtual machines and other abstraction methods can create analysis frameworks that implement and integrate formal method techniques. Examples include the LLVM (Low Level Virtual Machine) Project and NASA JAVA Pathfinder (JPF). The Contractor shall conduct research to improve analysis frameworks in terms of capabilities, library coverage, scalability and precision in terms of coverage, applicable environment (e.g. ARINC 653 to the more complex POSIX (Portable Operating System Interface for Unix)), floating point, and the interplay between various techniques. The Contractor shall use these frameworks to support formal methods research: Model checking and analysis, compositional verification, probabilistic and mathematical approaches to verification, symbolic execution, C/C++ program analysis, program differencing to limit verification and validation (V&V) across different software versions, and smart test case coverage of the verification and validation state space.

The Contractor shall support extensions of formal methods to encompass distributed teams of humans and automation interacting for a common goal such as the next generation air space system. Techniques shall include compositional verification of human/machine interactions and products of this research should feed into and take advantage of the works on C/C++ program analysis, JPF, and advanced testing.

The Contractor shall support advanced V&V research for non-deterministic algorithms (e.g. prognostics, adaptive control) and software health management and devise novel techniques to co-design software and hardware systems that, at the system level, are easier to verify and validate. Contractor shall investigate safety critical capability based on the use of virtual machines (e.g., Android). The verification aspect of such a capability should build on the JPF experience.

The safety assurance technology theme focuses on certifiable code synthesis and safety cases. The work on certifiable code synthesis consists of researching technology to generate condition verifications (CV) as the same time as generating code from high-level, domain-specific models. CVs can be discharged using theorem-proving technology. Probabilistic aspects should be investigated. Certifiable code synthesis will also be used to provide formal arguments for the research on safety cases, and in particular, on mixing formal and informal arguments. The Contractor is expected to lead research using NASA relevant problems.

Model-based software engineering and applications theme applies RSE tools for software generation in support of NASA missions. The Contractor shall support refinement of the infrastructure for rapid development and deployment of software in support of NASA missions This includes developing the capability to produce mission critical software from dynamic systems models using automatic code generation. Applications of model-based techniques include development of simulation frameworks, Processor-in-the-Loop (PIL) testbeds, and Hardware-in-the-Loop (HIL) testbeds. Support tools will be developed that provide interfaces and integration with RSE tools: advance verification and validation and safety assurance techniques, and report logging to feedback results for RSE researchers. The Contractor is expected to identify opportunities in the development process for conducting early-in-design verification and test.

The Contractor will support a student program with students that have relevant research and work history. Students will be mentored by senior researchers to support the NASA projects and milestones.

In support of the three themes, the Contractor will provide software development support with state-of-the-art experience in engineering and testing of embedded, application, and processing software in a variety of languages (C, C++, Python, Java, Matlab, Simulink) and on a variety of platforms (Linux, OS-X, Windows, VxWorks). Application frameworks include Eclipse, JAVA, LLVM, and ANDROID.

2.3 Indefinite Delivery Indefinite Quantity (IDIQ) Areas

2.3.1 Technical Research Areas

It is anticipated that additional requirements for research under Section 2.2 will be required during the performance of the contract. These additional requirements will be issued under contract task orders.

2.3.2 Flight Operations

Ames Research Center has successfully designed, built and flown a number of spacecraft, both small and large, dating back to Pioneer in the 1960s and Lunar Prospector in the late 1990s. In recent years, Ames has flown Small Spacecraft Missions, such as GeneSat and PharmaSat, as well as full-scale spacecraft, such as the Lunar Crater Observation and Sensing Satellite (LCROSS) and Kepler and the upcoming Lunar Atmosphere and Dust Environment Explorer (LADEE) and Interface Region Imaging Spectrograph (IRIS) missions. In addition, it also supports operation of the International Space Station (ISS) payloads and science instrumentation, such as European Modular Cultivation System (EMCS), and Synchronized Position Hold, Engage, Re-orient, Experimental Satellites (SPHERES). Ames employs experienced project management, flight operations teams, and has a proven multi-mission operations center.

Ames specializes in the development and execution of innovative low-cost flight operations. Ames flight teams draw from a broad range of experience leading or collaborating on heliocentric, planetary, lunar, and earth orbiting science and exploration missions. Ames collaborations with other flight centers on manned missions further augment their experience base. With operations exposure over the full range of mission risk classifications (Class D through A), Ames staff are uniquely postured to leverage the best mix of skills and lessons learned to each mission it performs.

The Division performs research in the full range of flight operations capabilities. These capabilities include Mission Design, Mission Planning, Mission Operations Management, Spacecraft System Engineering, Command Planning and Sequencing, Spacecraft Command and Telemetry Processing, Communications Design and Link Management, Spacecraft Simulation Testbed Development and Operation, Ground System Development, Ground System Management, Science Payload Development and Operation, and Flight Dynamics (Orbit Determination, Navigation, Attitude and Maneuver Design).

Ames flight operations teams maintain a healthy working relationship with other flight centers. For example, the Ames LCROSS mission flight team Mission Maneuver and Design subsystem worked with the Jet Propulsion Laboratory (JPL) and Goddard Space Flight Center (GSFC) for navigation, orbit determination and Trajectory Correction Maneuver (TCM) attitude planning, and with JPL for Deep Space Network (DSN) scheduling. The Ames LADEE mission flight team will perform these tasks in-house at Ames, but will integrate with the science operations center at GSFC. The Ames IRIS mission flight team will integrate with the science operations center at Lockheed. Ames flight teams continue to look to the NASA centers for expertise and partnerships wherever it is most cost effective and beneficial to the mission and NASA.

Many of the Ames Flight Operations staff gained their trained and experience through participation on flight projects and programs with JPL, JSC, GSFC, KSC and MSFC. Ames continues to pursue these flight operations collaborations.

2.3.3 Multi-Mission Operations Center

The Ames Multi-Mission Operations Center (MMOC) enables and supports flight and science operations for Ames spaceflight missions. The MMOC is composed of the facilities, networks, IT equipment, software, and support services needed by flight projects to effectively and efficiently perform all mission functions, including planning, scheduling, command, telemetry processing, and science analysis.

Missions utilizing the MMOC have access to voice loops connecting all NASA flight centers. Live video streams from launch operations at the Cape and from the International Space Station are also available. Data processing capabilities include telemetry and science data handling, storage, distribution, and archiving. Telemetry and science data can be distributed real-time via secure, dedicated network links. Select data can also be made available via the Internet. The MMOC enables ground data systems interfaces to ground support equipment, including hardware-in-the-loop simulators. When required, the MMOC can implement system redundancy to achieve high operational availability.

The MMOC is configurable to support use of the software tools that each mission requires. Command and telemetry handling software deployed in the MMOC include ASIST and ITOS, but any similar application can be accommodated. Currently, the MMOC is implementing the GMSEC modular software architecture so that various command and telemetry applications can be easily plugged in.

2.3.4 Software Systems Engineering and Software Project Management

In addition to being a fundamental research organization, the Division will also develop and deploy applications to customers at other NASA Centers, other Federal agencies, and industry. These applications are infusions of technology developed through Division research. The focus of this area is to apply standard engineering practices to deliver reliable applications, within schedule, and within budget. Current recipients of Division technology infusion include:

1. The ARC Small Spacecraft Office (SSO) develops, launches, and operates small space missions using a low-cost methodology. The objective is to develop missions in less time, at lower cost, and capable of delivering highly useful scientific and technical payloads in order to aid future NASA missions. One of the primary goals is to develop the capability within NASA to have space vehicles that could be deployed faster and cheaper than conventional spacecraft today in order to expand the number of flight opportunities and to take advantage

of the latest technologies through shorter development cycles. In order to achieve low cost access to space, the SSO looks at alternative launch vehicles, as well as hardware developed under past and current Department of Defense (DoD) investments.

The activities of the Small Spacecraft Office include technology evaluation, proposal development, spacecraft hardware development, and mission implementation and operations. The SSO evaluates technology and processes that can enable low-cost spacecraft development, such as structures, avionics, sensors, flight software, propulsion, integration and testing, and mission operations. These components are used to develop full mission proposals that, if selected, could lead to mission development projects. Current projects include earth orbiting nano- and micro- spacecraft, as well as deep-space spacecraft bus designs.

2. Johnson Space Center Mission Operations Directorate (MOD) Projects:

   a. Solar Array Constraint Engine (SACE) – assists the Power, Heating, Articulation, Lighting and Control (PHALcon) flight controllers to manage the orientation and operation of the new ISS solar arrays.
   b. Inductive Monitoring System (IMS) – monitor sand compares multiple telemetry streams from the ISS control moment gyros to provide decision support.

3. NASA/NOAA-GOES-R Ground Segment Project Non-Advocate Assessment

   Software non-advocate assessment is performed only on critical software that is safety or security critical, and/or software that is necessary for spacecraft operations. Assessment activities will revolve around three components: requirements analysis, design analysis and implementation analysis

   Assessment is performed on Mission Management (MM), and for software generating and delivering Key Performance Parameters (KPPs) to the Advanced Weather Interactive Processing System (AWIPS) performed within the Product Generation (PG) and Product Distribution (PD) elements.

   Critical software includes both developmental software (software to be developed under the GOES-R GS project) and non-developmental software such as off the shelf products and OTS products that require customization for use in GOES-R GS.

4. Lunar Atmosphere and Dust Environment Explorer (LADEE) Mission Operations Systems (MOS) and Flight Software (FSW)

   The LADEE mission will address science goals by examining the Moon's atmosphere and dust in the Moon's vicinity. The Division leads development and operation of the LADEE Mission Operations and Ground Data Systems, as well as the development of the flight software that will be used to operate the spacecraft. The latter includes development and deployment of model-based simulations of the spacecraft and subsystems, and associated software development and simulation infrastructure.

In order to successfully support the development and deployment of Division technologies in these areas, the Contractor will be required to have expertise in:

(1) System architecture design
(2) System configuration definition and implementation
(3) Security requirements during the system design
(4) Integration of project systems into the division facility
(5) Development and design of laboratories and testbeds for the various technologies
(6) Network management of infrastructure to support project requirements
(7) Security plan development for systems and projects
(8) Configuration and security control of real time operating systems
(9) Setup and configuration of avionics hardware testbed platforms
(10) Security and customization of embedded operating systems and micro-kernels
(11) Application of and compliance with NASA software engineering process requirements and standards, including but not limited to NASA procedural requirement 7150.2 software engineering, NASA NASA-STD-8739.8 software assurance and NASA-STD-8719.13b software safety
(12) Application of CMMI Maturity Level 2 processes as called for by NASA software engineering requirements

The Contractor shall be responsible for communicating knowledge about division technologies to technical and non-technical audiences as required by division projects. This communication includes the design, development and distribution of informational products in a wide variety of output formats including written, graphical, and electronic media, and live or static demonstrations.

Contractors shall perform the following tasks:

(1) Technical writing and editing
(2) Web site content development and maintenance
(3) Interfacing with technology groups to develop project requirements and acquire data
(4) Collect, format and distribute highlight reports to line and program management
(5) Compile and update research portfolios for line and program management

3.0 QUALITY ASSURANCE

In support of CTOs issued, the Contractor shall comply with the technical and management process requirements of the Ames Management System. This includes following applicable Ames' procedures that are subject to audit, and preparing for and participating in process audits as required by Center and Agency authorities. The Contractor shall attend relevant training, provided by the Government, as required for all on-site employees. Specific procedures will be indicated on each task order response. These procedures include, but are not limited to, the following AMS documents:

NPD 1280.1	NASA Management Systems
APR 1280.1	Ames Management System (AMS)
NPD 8730.5	NASA Quality Assurance Program Policy

4.0 DELIVERABLES

Products and services requirements shall be defined at time of award for the core research and for each task order.

5.0 PHASE-IN/PHASE-OUT

a) Phase-In

(1) The services provided by this contract are vital to the Government's overall effort. Therefore, continuity of these services must be maintained at a consistently high level without disruption. The Contractor is expected to meet full performance requirements upon contract start through the life of the contract.

(2) The Phase-In period shall not exceed **60 calendar days** prior to the start date of the base contract period. The Contractor shall accomplish Phase-In in accordance with the Contract Phase-In Plan, Attachment J-10.

(3) Once the 60 calendar day phase-in period is complete, the Contractor shall assume full responsibility for the effort covered by the SOW and as issued through Task Orders.

(4) During phase-in, the Contractor (at a minimum) shall:

(i) Participate in meetings with the predecessor Contractor(s) to identify and discuss problems or areas requiring attention during the phase-in period; and

(ii) Perform all activities described in the Contractor's phase-in plan submitted with its proposal, and all activities necessary, to ensure effective transfer of all effort from the predecessor Contractor(s) and readiness to assume full contract performance. As a minimum, phase-in must include the following: all personnel must be trained and must meet contract requirements (e.g., certifications, permits); all Installation Accountable/Government Furnished Property must be inventoried; qualified staff must be available and ready to assume performance (and must have obtained security clearances (if required) and been badged by ARC).

(5) The total firm fixed price of all Phase-In activities shall not exceed the price set forth in clause B.3 - Contract Phase-In (Firm Fixed Price). Any costs incurred in excess of this amount shall be unallowable under this or any other government contract.

(b) Phase-Out

(1) Prior to contract completion, a successor Contractor(s) may be selected to perform the work requirements covered by the SOW. The Contractor shall conduct an orderly phase-out of contract

activities prior to completion of this contract and assumption of responsibility for the effort described in the SOW by a successor Contractor(s). The Contractor shall remain responsible for the effort covered by the SOW during phase-out activities.

(2) Upon written notice by the Contracting Officer, the Contractor shall conduct phase-out activities for up to **90 calendar days** prior to the contract completion date, including:

(i) Support periodic meetings with the successor Contractor(s) to identify and discuss problems or areas requiring attention during the phase-out period; and

(ii) Negotiate in good faith, a plan with the successor Contractor(s) to determine the nature and extent of phase-in and phase-out activities required. The plan shall include effective transfer of all effort to the successor Contractor(s); training of personnel; and any other agreements or steps necessary to ensure a smooth transition between the contracts. The plan shall be subject to the Contracting Officer's approval.

(3) Close-Out activities shall be accomplished in accordance with FAR 52.237-3 "Continuity of Services." The Contractor shall accomplish Close-Out in accordance with, Contract Closeout Plan.

APPENDIX

Definitions

- AI: Artificial Intelligence.
- AES: Advanced Exploration Systems (HEOMD Program)
- ARC: NASA's Ames Research Center, Moffett Field, California
- ARMD: Aeronautics Research Mission Directorate
- CO: Contracting Officer, the primary point of contact between the contractor and the Government
- COR: The Contracting Officer's Representative, charged with providing the CO with technical information and assessments about the contract
- CSO: Computer Security Official
- CTOs: Contract Task Orders.
- DOD: Department of Defense
- GFE: Government Furnished Equipment
- HEOMD: Human Exploration and Operations Mission Directorate
- HET: Human Exploration Telerobotics (HEOMD Program)
- HRS: Human Robotics System (HEOMD Program)
- IDIQ: Indefinite Delivery, Indefinite Quantity
- IMS: Inductive Monitoring System
- ISRDS: Intelligent Systems Research and Development Support
- IT: Information Technology
- ITRDO: Information Technology Research, Development, and Operations
- JSC: NASA Johnson Space Center
- MMOC: Multi Mission Operations Center
- MOD: Mission Operations Directorate
- MOS: Mission Operations Systems
- NASA: National Aeronautics and Space Administration
- OCT: Office of Chief Technologist
- POC: Point of contact – the designated contact person
- SACE: Solar Array Constraint Engine
- SMD: Science Mission Directorate
- SMO: Software Management Office
- SOW: Statement of Work
- SSO: Small Spacecraft Office
- ST: Space Technology (OCT Program)